

# Characterization and Consolidation of Laboratory Wastes

The DOT Lab Pack Regulations  
49 CFR 173.12(b)

# Objectives

**The participant will be able to explain;**

- The DOT definition of a lab pack
- Acidic and basic compounds
- Materials prohibited as lab packs
- Proper physical packaging of lab packs

## **DOT vs. EPA**

- **DOT addresses how to package and transport a lab pack**
  - 49 CFR 173.12(b)
- **EPA addresses how to dispose of a lab pack**
  - 40 CFR 268.42(c)

## DOT Lab Pack Definition

- Found under 49 CFR 173.12(b)
- Only applies to wastes that are  
**3, 4.1, 4.2, 4.3, 5.1, 6.1, 8 or 9**
- “...two or more chemically compatible waste materials in the same hazard class are packaged in the same outside packaging.”





# DOT Hazard Classes

- 3 – Flammable Liquids**
- 4.1 – Flammable Solids**
- 4.2 – Spontaneously Combustible**
- 4.3 – Dangerous When Wet**
- 5.1 – Oxidizers**
- 6.1 – Toxic Materials**
- 8 – Corrosive Materials**
- 9 – Miscellaneous**

# DOT Hazard Class Determination

- **How do we determine the hazards of a chemical?**
  - Chemistry knowledge
  - DOT literature
  - Chemical dictionary
  - NIOSH Pocketguide
  - MSDS
  - Aldrich literature
  - Clean Harbors Tech Services Helpline
  - Field testing (if chemical is unknown)

# DOT Hazard Class Determination

## Hexane

- The first ten hydrocarbons are all flammable gases or liquids (methane to decane)
- Chemical dictionary says it is a liquid with a flashpoint of -9°F
- DOT classifies a flammable liquid as any liquid with a flash point no greater than 140°F.
- No literature identifying hexane as toxic, corrosive, explosive, radioactive, etc.
- DOT specifically lists hexane as a flammable liquid

# DOT Hazard Class Determination

## Sulfuric Acid

- Chemical dictionary says it is a liquid that can corrode steel and tissue.
- The label on the bottle may say “Warning, Corrosive to Tissue”.
- DOT classifies a corrosive as any material which can corrode steel, tissue or aluminum.
- No literature identifying sulfuric acid as toxic, flammable, explosive, radioactive, etc.
- DOT specifically lists sulfuric acid as corrosive

# DOT Hazard Class Determination

## Sodium-Potassium Alloy (NaK)

- Chemical dictionary says it is highly water reactive.
- MSDS says it is water reactive.
- Aldrich catalogue says it is water reactive and corrosive to tissue.
- No literature identifying NaK as flammable liquid, toxic, corrosive (by DOT definition), explosive, radioactive, etc.
- DOT classifies a water reactive material as any material that produces flammable gas when exposed to water.
- DOT specifically lists NaK as a water reactive substance.



# Lab Pack Definition

## Outer Containers

- UN1A2 (open top steel drums)
- UN1B2 (open top aluminum drums)
- UN1D (plywood drums)
- UN1G (fiber drums)
- UN1H2 (open top plastic drums)



Drums can be  
of any size.

# Lab Pack Definition

## Inner Containers

- Plastic, not exceeding 5.3 gallons (20 liters)
- Metal, not exceeding 5.3 gallons (20 liters)
- Glass, not exceeding 1 gallon (4 liters)



# Lab Pack Definition

- **All containers must be packed with an absorbent that is chemically compatible.**
- **Maximum gross weight is 452 pounds (205 kilos).**
- **Each container may contain only one class of hazardous material.**

# Chemically Compatible Absorbent

- **Vermiculite**
  - Light, non-reactive, cheap
- **Absorbent Clay**
  - Heavy, non-reactive, very absorbent
- **Polysorb**
  - Only for hydrofluoric acid, expensive



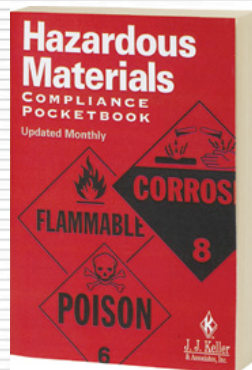
# Maximum Weight 452 Pounds

- **The rule of thumb is nothing heavier than 50 pounds each**
- **Don't put anything in the drum you can't take out**



# Only One Primary Hazard Class Per Container

- Everything in the drum must be the same primary hazard.
- How do you determine primary hazard?



Symbols	Hazardous materials descriptions and proper shipping names	Hazard class or division
1	2	3
	Acetone	3
	Acetic acid, glacial or Acetic acid solution, with more than 80 percent acid by mass	8
	Chloroform	6.1
	Hydrochloric acid	8

# Only One Primary Hazard Class Per Container

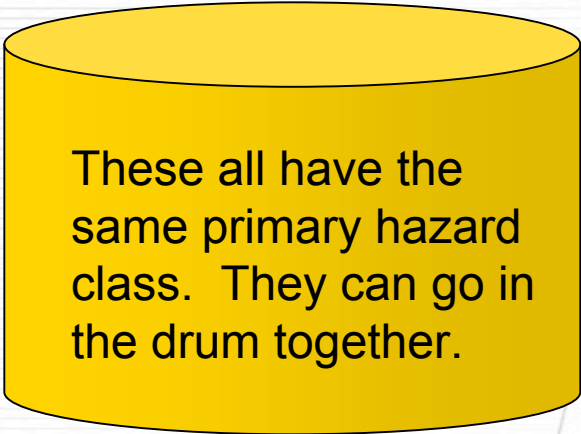
**Acetone is 3**

**Benzene is 3**

**Toluene is 3**

**Butyronitrile is 3, 6.1**

**Bromoacetone is 6.1, 3**



These all have the same primary hazard class. They can go in the drum together.

Yes, this is flammable, but the primary hazard is toxic, thus it can not go in the same drum.

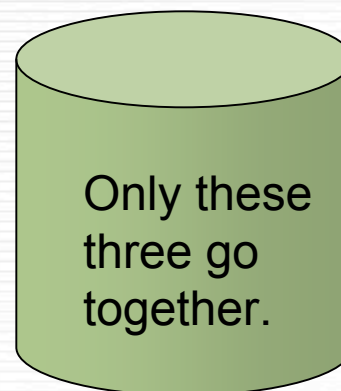
# Only One Primary Hazard Class Per Container

**Ethyl bromoacetate is 6.1, 3**

**Ethyl bromide is 6.1**

**Ethyl chloroacetate is 6.1, 3**

**Ethyl butyrate is 3**



**This must go by itself.**

# Only One Primary Hazard Class Per Container

**The primary hazard class requirement allows easy selection of proper shipping descriptions.**

Acetone is 3

Benzene is 3

Toluene is 3

Hexane is 3

**Flammable liquid, n.o.s., 3, UN1993, II**

# Only One Primary Hazard Class Per Container

**The primary hazard class requirement allows easy selection of proper shipping descriptions.**

Acetone is 3

Benzene is 3

Toluene is 3

Isobutyryl chloride is 3, 6.1

**Flammable liquids, toxic,  
n.o.s., 3(6.1), UN1992, II**



# Chemical Compatibility

- Acids and bases are both hazard class 8. Can I pack them into the same drum?
- They may both be class 8, but there are big differences between acids and bases.



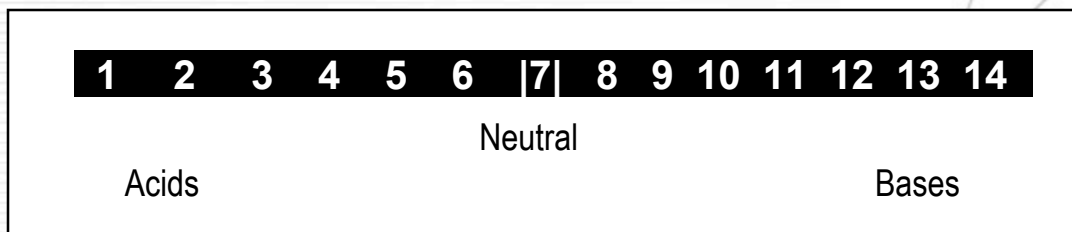
# Chemical Compatibility

## Acid

- pH less than 7
- Turns litmus red
- Sour taste
- Attacks tissue
- Attacks metal

## Base (caustic, alkaline)

- pH greater than 7
- Turns litmus blue
- Bitter taste
- Attacks tissue



# Chemical Compatibility

**Acids and bases will react with one another to form salt and water. However, this reaction can be very violent. They are both class 8, but must be packed separately.**



# Chemical Compatibility

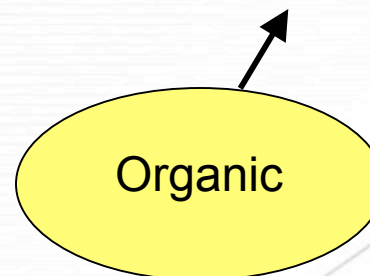
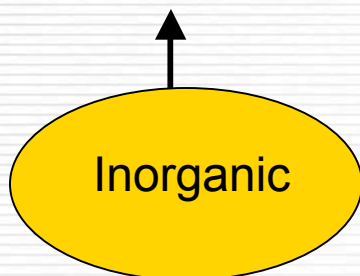
**Besides acids and bases, there are other materials that are the same hazard class, but are incompatible with one another.**



# Chemical Compatibility

**Some inorganic oxidizers can react with organic oxidizers. They are incompatible, so they must be packed separately.**

Calcium hypochlorite can react with Trichloro-s-triazinetriene





# Chemical Compatibility

**Furthermore, when addressing the compatibility issue, we need to look at subsidiary hazards.**

**Glacial Acetic Acid**

Hazard class 8, 3

**Nitrating Acid Mixtures**

Hazard class 8, 5.1

$$3 + 5.1 = \text{Explosion}$$

For safety, these  
can't go in the  
same drum.

# Prohibited Materials

**The following materials may not be lab packed**

- PIH materials
- 6.1, PGI materials
- 4.2, PGI materials
- Chloric acid
- Oleum (fuming sulfuric acid)
- Gases (2.1, 2.2 & 2.3) and Organic Peroxides (5.2) are not lab packs



# Prohibited Materials

## PIH Materials (Inhalation Hazards)

- Bromine
- Nitric acid, red fuming
- Chloroacetonitrile
- Titanium tetrachloride
- Nickel carbonyl
- Trichloroacetyl chloride



# Prohibited Materials

## 6.1, PGI Materials

- Allylamine
- Chloropicrin
- Sodium cyanide
- Methylhydrazine
- Phenyl mercaptan
- Potassium fluoroacetate



# Prohibited Materials

## 4.2, PGI Materials

- Aluminum alkyls
- tert-Butyl hypochlorite
- Phosphorus, white dry
- Pentaborane





# Prohibited Materials

## Chloric Acid

- 5.1
- PGII



## Oleum

- 8, 6.1
- PGI
- PIH- Zone B



# Prohibited Materials

## **Gases (2.1, 2.2, 2.3)**

- Must be shipped individually or
- Shipped with a special permit

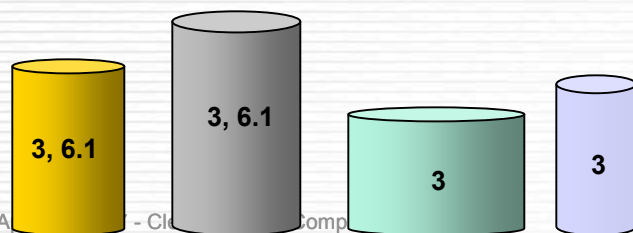
## **Organic Peroxides (5.2)**

- Always have to be packaged individually

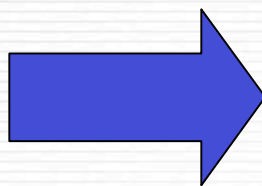
# Physically Packing Drums

**Okay, we know what can and can not be packed together.**

**Now, how do we actually pack the drum?**



**First, segregate the chemicals  
to be packed together.**





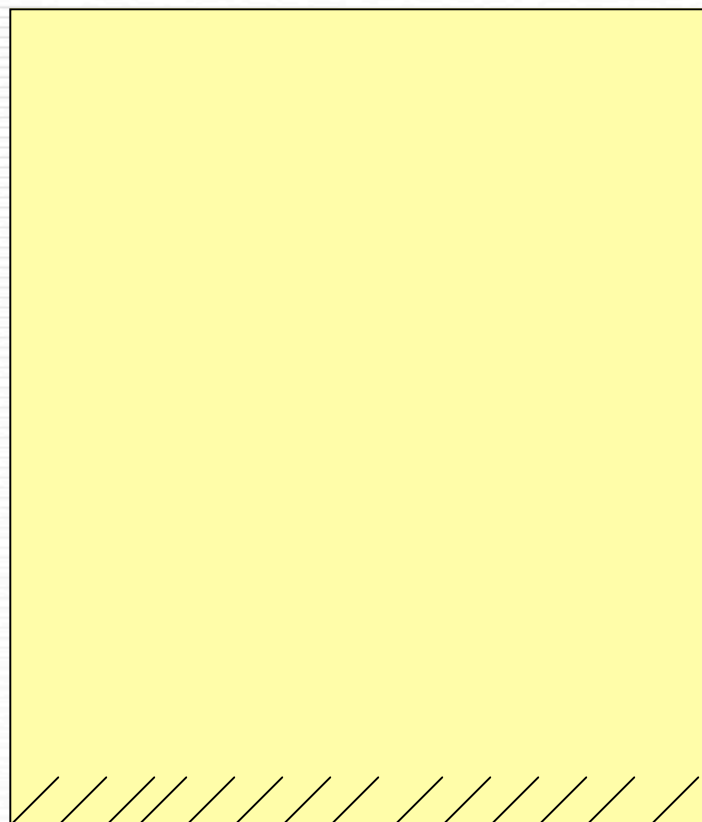
**Once segregated, we know how many and what size drums we will need.**





# Packing Drums

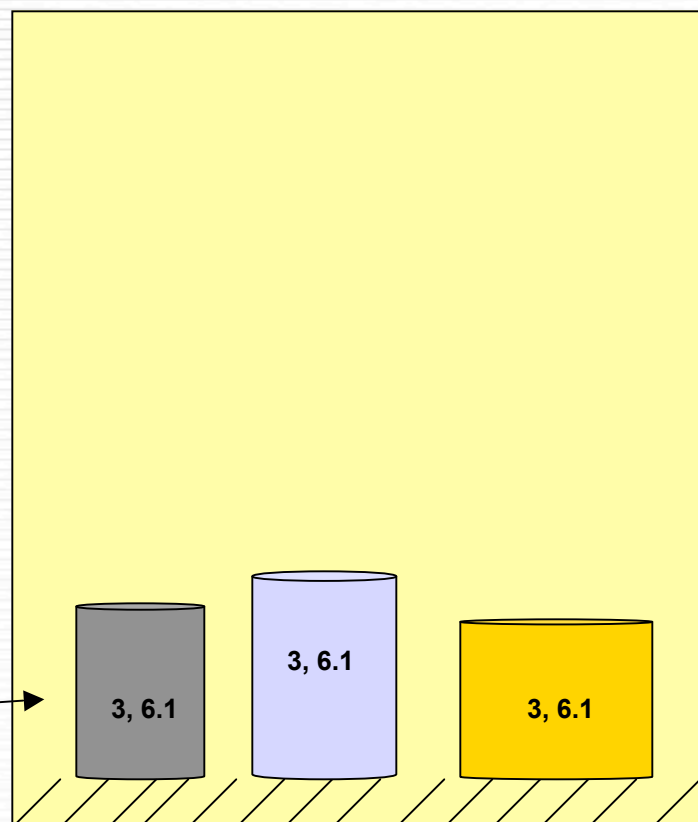
**Start with a couple inches  
of absorbent (verm) on the  
bottom of the drum.**



# Packing Drums

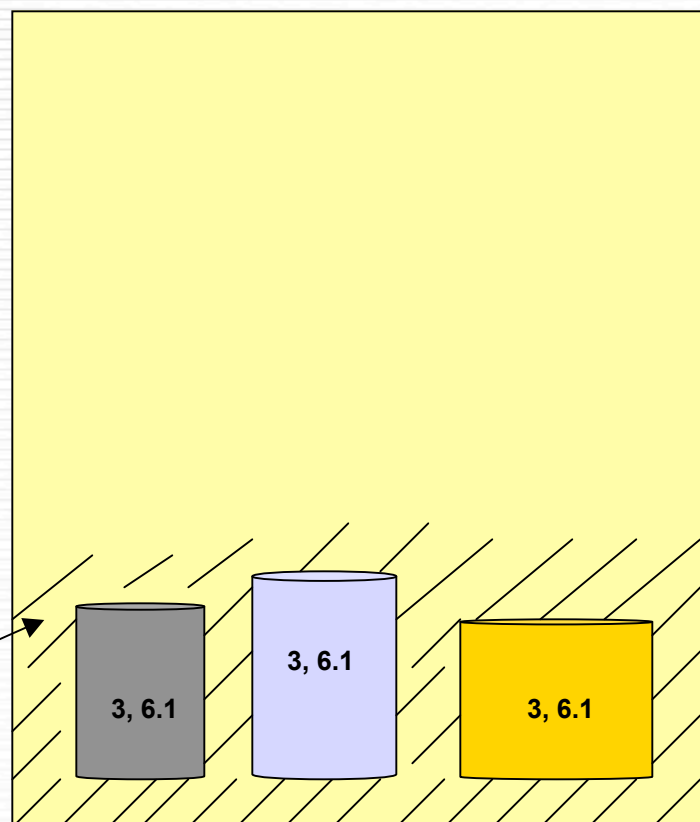
All inner containers must be closed, not leaking, not reacting and packed with closures facing up.

**Place bottom layer of containers in drum. Leave space between them.**



# Packing Drums

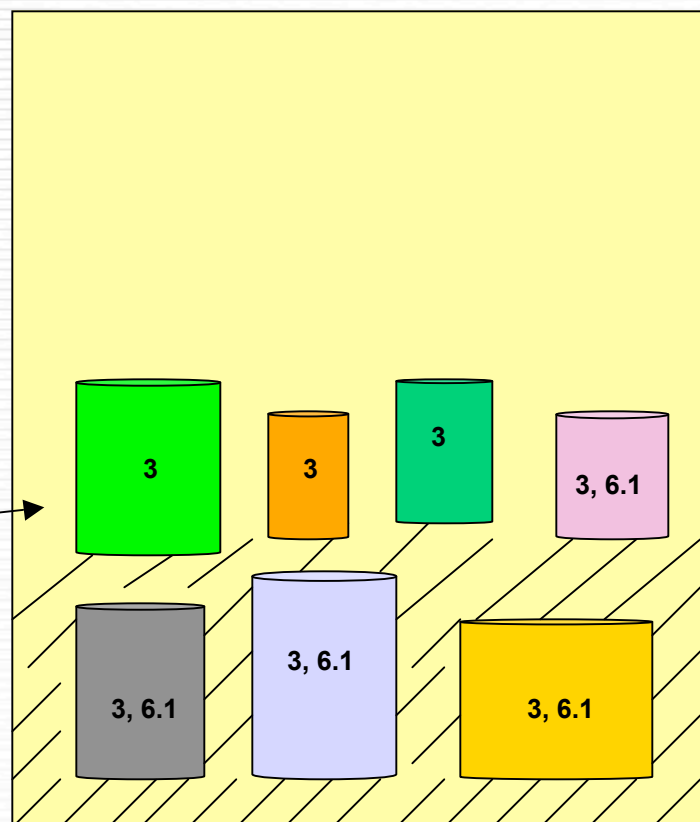
**Place verm between and completely covering containers.**



# Packing Drums

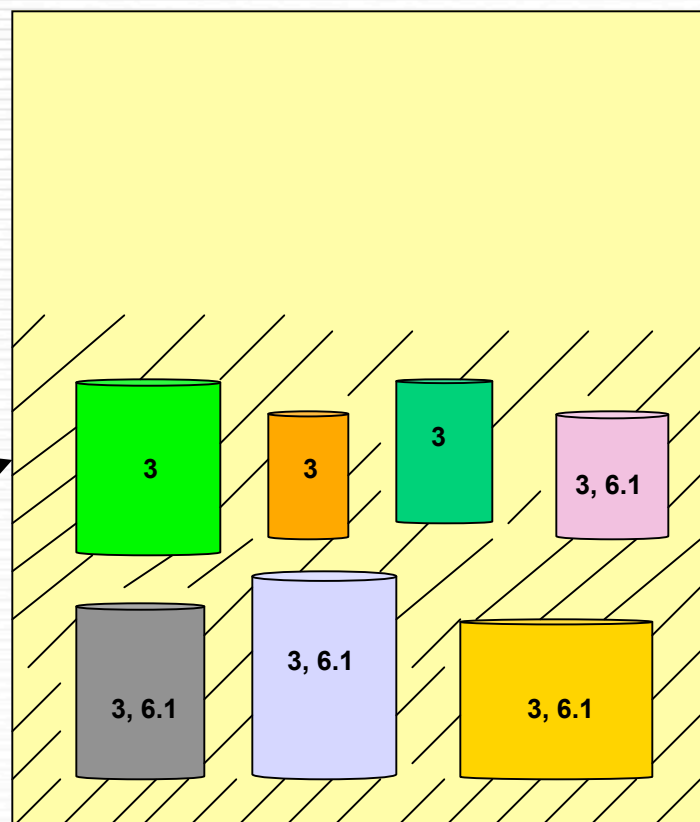
All inner containers must be closed, not leaking, not reacting and packed with closures facing up.

**Add second level of containers.**



# Packing Drums

Add second level of verm.

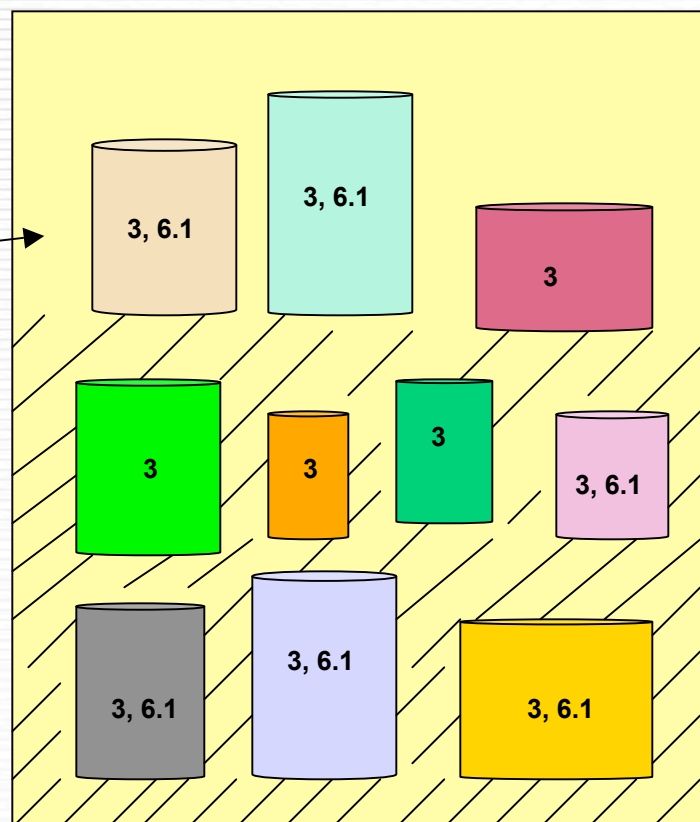




# Packing Drums

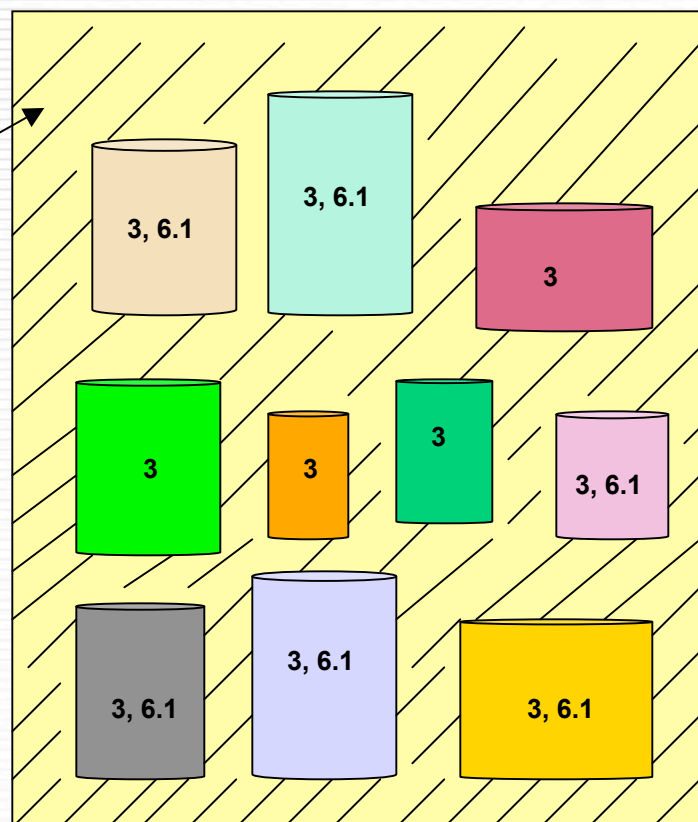
All inner containers must be closed, not leaking, not reacting and packed with closures facing up.

**Add third level of containers.**



# Packing Drums

**Top off with verm.  
Shake drum to allow  
verm to settle. Then  
top off with verm  
again.**

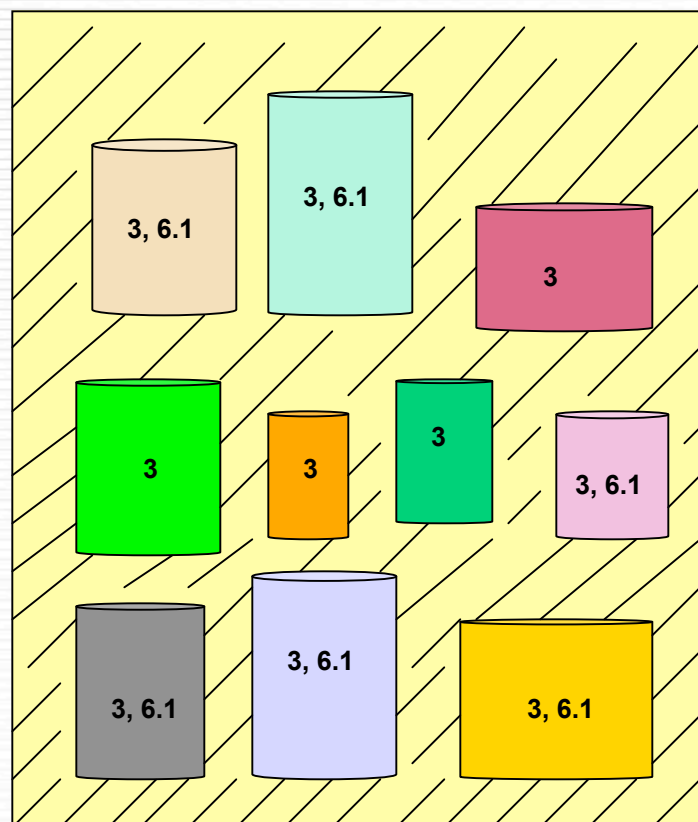


# Packing Drums

Select Shipping Description:

Everything in the drum is flammable, and some have a subsidiary hazard of toxic.

**Flammable liquids, toxic, n.o.s.**

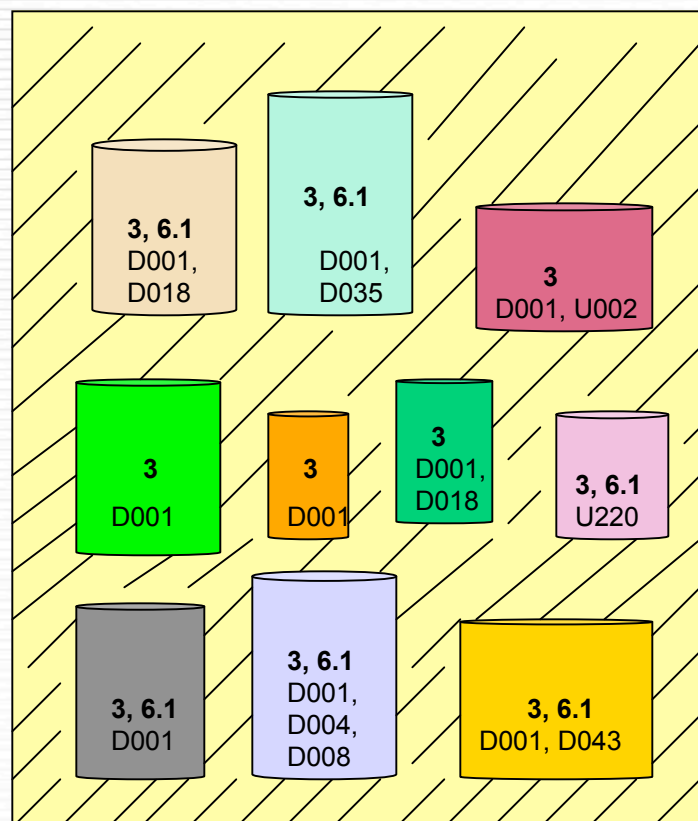


## “Waste” in Name

If any RCRA codes are assigned to an inner container, the drum is classified as hazardous waste and must be shipped on a manifest.

If a RCRA waste must be shipped on a manifest, “Waste” must precede the shipping description.

**Waste Flammable liquids,  
toxic, n.o.s.**




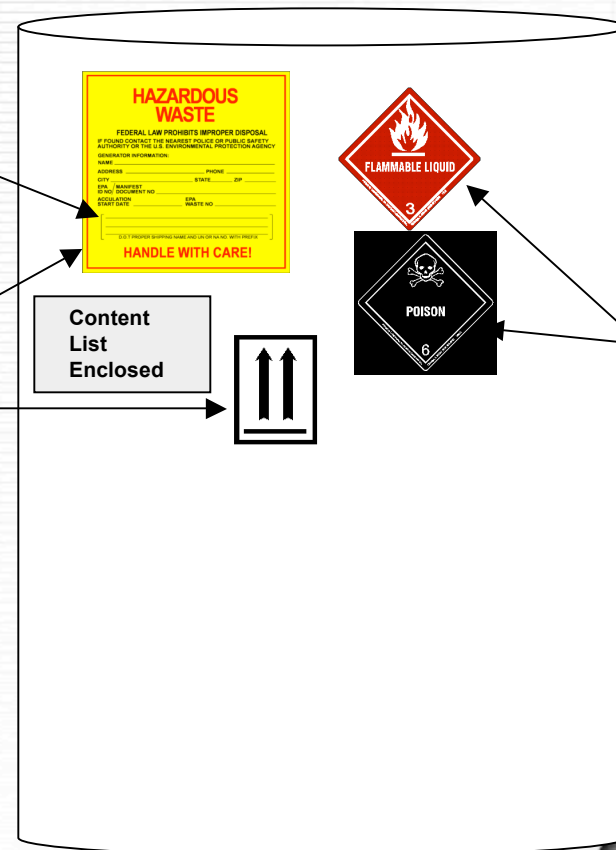
# Labeling and Marking Lab Packs

Waste Flammable liquids, toxic, n.o.s., 3 (6.1),  
UN1992, PGII

Marking

Label

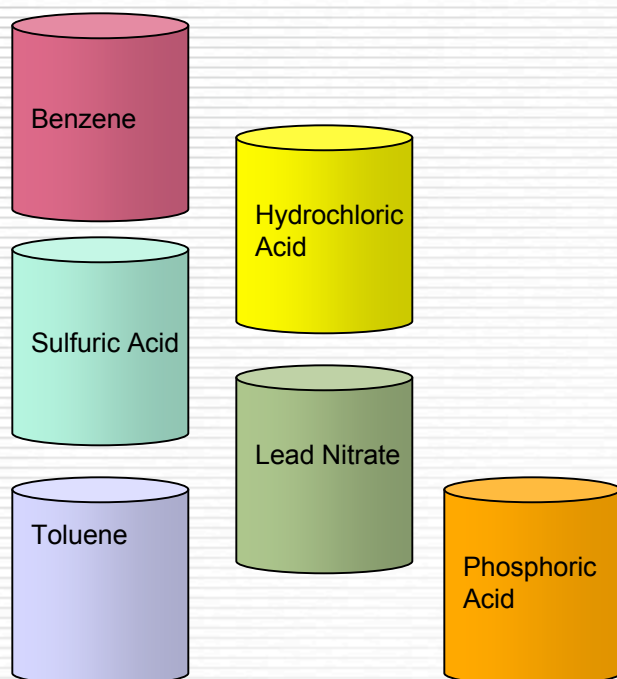
Please Note: Orientation marking, , must be on container twice. It is required for all containers holding inner bottles of liquids (lab packs).





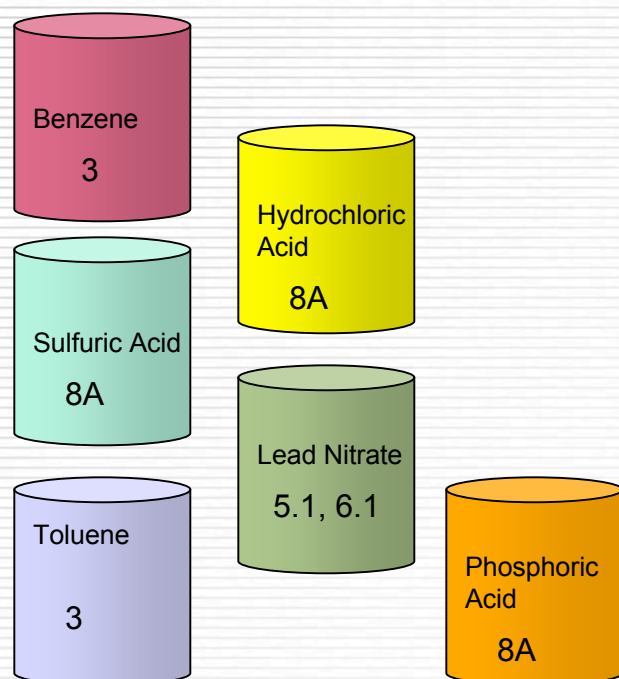
# Example

A client has the following materials for disposal.



First, segregate the materials to be packed together.

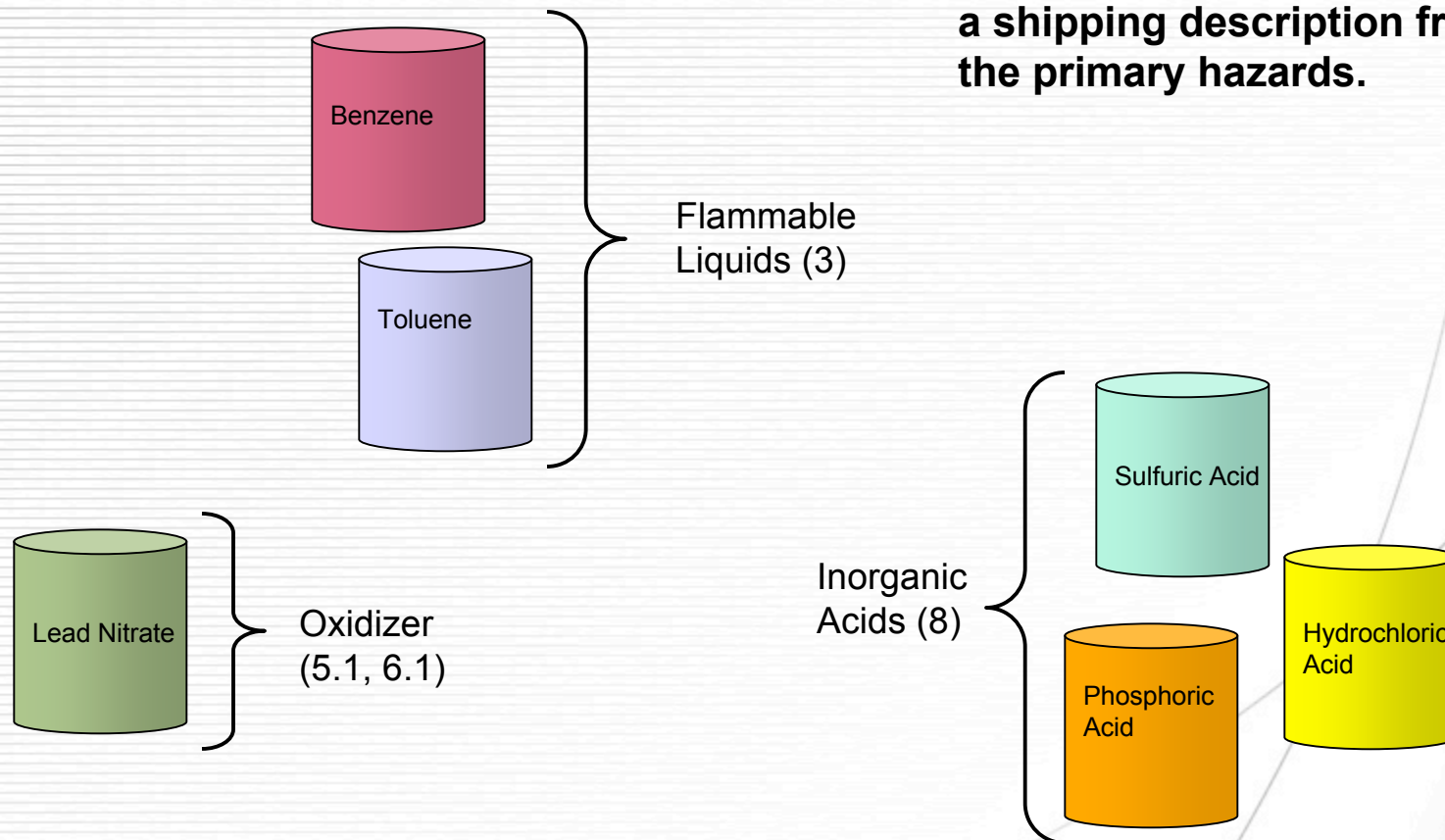
# Example



**As you see, we have:  
corrosives (acids),  
flammable liquids,  
and an oxidizer.**

# Example

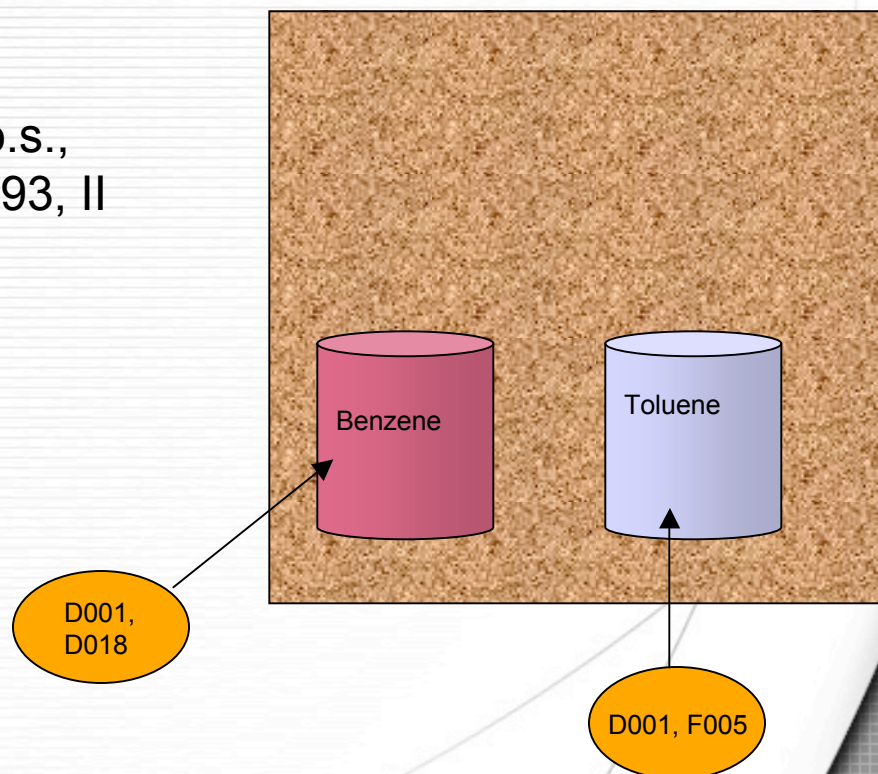
After segregation, we can pack containers and select a shipping description from the primary hazards.



# Drum 1

## Shipping Description:

Waste Flammable liquids, n.o.s.,  
(Benzene, Toluene), 3, UN1993, II



# Drum 1

Shipping Description:

Waste Flammable liquids, n.o.s.,  
(Benzene, Toluene), 3, UN1993, II

**HAZARDOUS WASTE**

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL.  
IF FOUND CONTACT THE NEAREST POLICE OR PUBLIC SAFETY  
AUTHORITY OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY.

GENERATOR INFORMATION:  
NAME \_\_\_\_\_ PHONE \_\_\_\_\_  
ADDRESS \_\_\_\_\_ CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_  
EPA ID NO. \_\_\_\_\_ RCRA ID NO. \_\_\_\_\_  
EPCRA ID NO. \_\_\_\_\_ CERCLA ID NO. \_\_\_\_\_  
EPCRA ID NO. \_\_\_\_\_ CERCLA ID NO. \_\_\_\_\_

**HANDLE WITH CARE!**

**UP**

**FLAMMABLE LIQUID**  
3

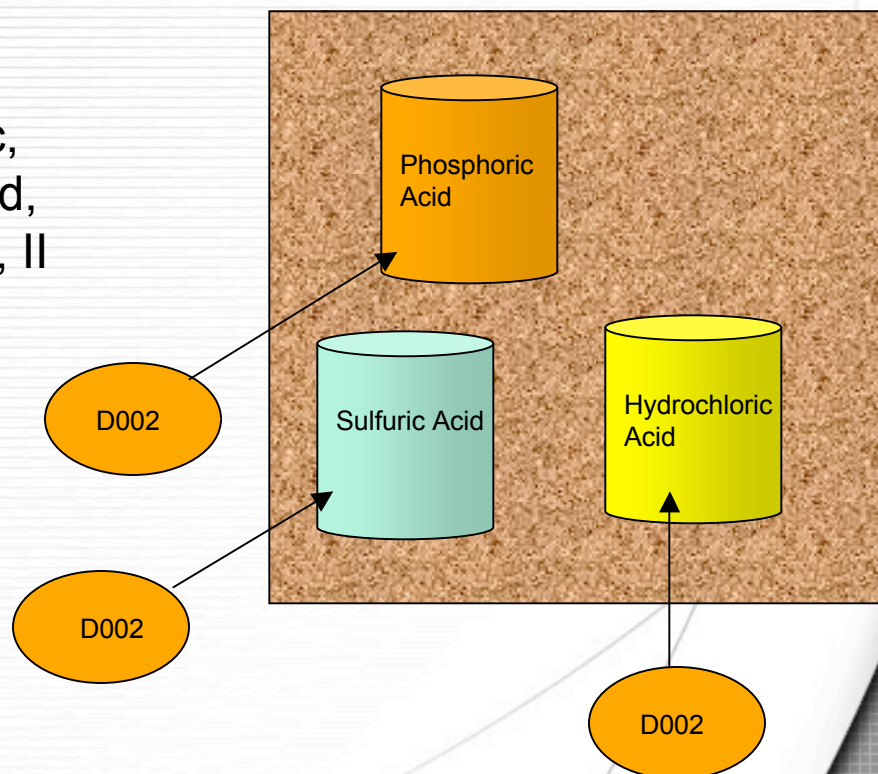
Packing  
List  
Enclosed



## Drum 2

### Shipping Description:

Waste Corrosive liquid, acidic,  
inorganic, n.o.s., (Sulfuric Acid,  
Phosphoric Acid), 8, UN3264, II



## Drum 2

### Shipping Description:

Waste Corrosive liquid, acidic,  
inorganic, n.o.s., (Sulfuric Acid,  
Phosphoric Acid), 8, UN3264, II

**HAZARDOUS WASTE**

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL.  
IF FOUND CONTACT THE NEAREST POLICE OR PUBLIC SAFETY  
AUTHORITY OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY.

GENERATOR INFORMATION:  
NAME \_\_\_\_\_ PHONE \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_  
EPA REGISTRATION NO. \_\_\_\_\_  
EPA ID NO. \_\_\_\_\_  
EPA ID NO. \_\_\_\_\_  
EPA ID NO. \_\_\_\_\_  
EPA ID NO. \_\_\_\_\_

**HANDLE WITH CARE!**

Packing  
List  
Enclosed

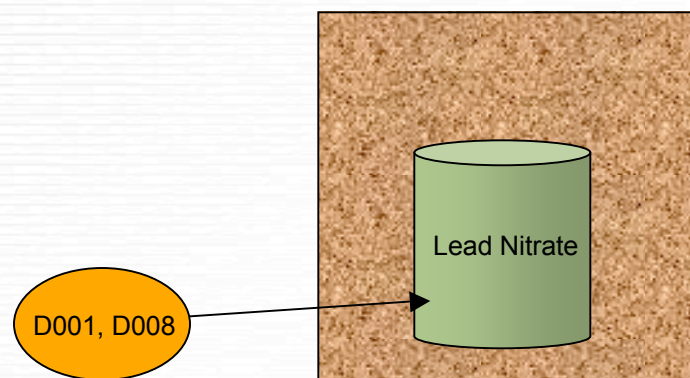
**UP**

**CORROSIVE**  
8

## Drum 3

Shipping Description:

Waste Lead nitrate, 5.1(6.1), UN1469, II



## Drum 3

Shipping Description:

Waste Lead nitrate, 5.1(6.1), UN1469, II





# What happens to our lab packs?

Approximately 98% of our lab packs will be depacked and repacked for disposal.

Ultimate disposal can be incineration, neutralization, landfill, fuels blending, recycling or deactivation.







# Additions to DOT Lab Packs

**We not only have to pack according to DOT regulations, we must also follow...**

## **RCRA Regulations**

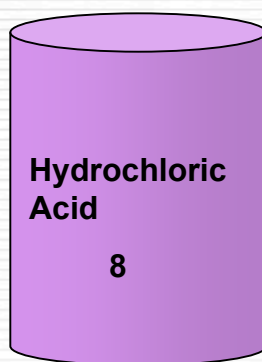
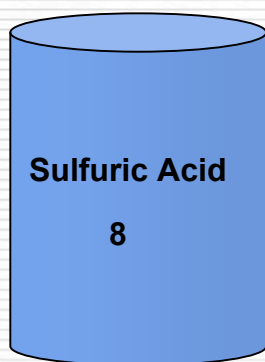
**EPA says some materials may not be disposed of as lab packs.**

## **Facility Restrictions**

**Facilities are permitted by what waste they can and can not accept.**

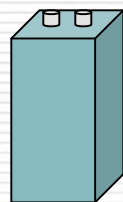
## For example...

**The battery has a different disposal facility  
and a completely different disposal process.  
The battery must be in a separate container.**



## For example...

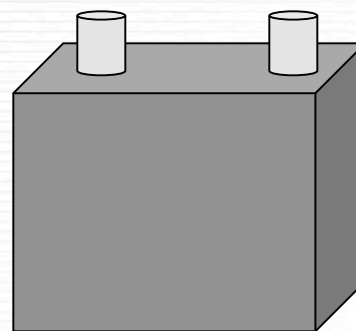
**Batteries can have different treatment processes, thus different disposal sites. These batteries must go in four separate drums.**



**Lithium Battery**  
D001, D003



**Mercury Button Batteries**  
D009



**Lead Acid Battery**  
D002, D008

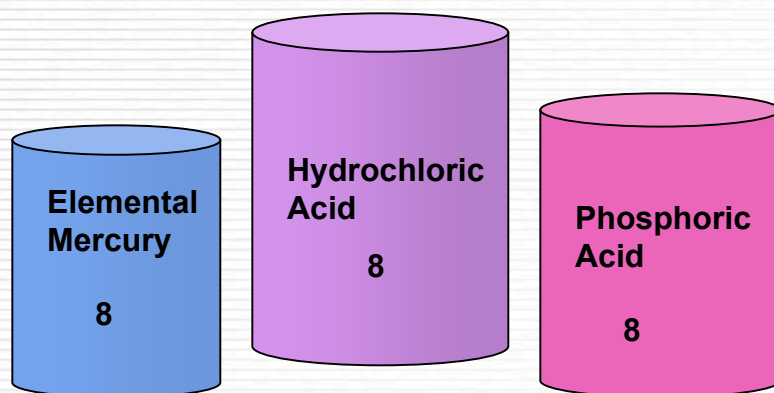


**Alkaline Battery**  
No RCRA Code



## For example...

**Mercury also has a different disposal facility and a completely different disposal process. Thus, it must be in a separate container.**



**These acids can be neutralized or incinerated, but the mercury must be recycled.**



# Segregation

- **177.848(c)**
  - Cyanides can not be transported with acids, if the mixture would evolve toxic gas, and
  - 4.2s can not be transported with corrosive liquids
- **As per 173.12(e)**
  - The lab pack regulations can also get us around these restrictions, but you have to follow the packing requirements.

# Segregation

- **As per 173.12(e)**
  - The lab pack regulations can also get us around these restrictions, but you have to follow the packing requirements.
    - The cyanides must be lab packed PGII or PGIII and the 4.2s must be lab packed PGII or PGIII.
    - The corrosives must be non-bulk containers only.
    - As well, the cyanides and 4.2s must be 4" off the floor of the vehicle and 4' from the corrosives.

# Summary

- Only one hazard class per drum
- All materials must be compatible
- No leaking or open containers
- No containers greater than
  - 5 gallons (plastic or metal)
  - 1 gallon (glass)
- Watch out for prohibited materials
- Use plenty of vermiculite



# Questions

